A Guide to Material Safety Data Sheets

Utah Department of Environmental Quality

Promoting a Healthy Environment

Knowing a product's ingredients, as well as the potential hazards associated with those ingredients, is essential in planning adequate protection from the dangers of a hazardous product.

Yet, not all products readily provide this basic information for consumers. If you decide to buy a product that does not give complete information about its hazardous ingredients, you may need to contact the manufacture or distributor and request a copy of the Material Safety Data Sheet (MSDS) for that product. The company address should be on the product label.

What makes a product hazardous?

A product is considered hazardous if it has one or more of the following properties:

- Flammable/combustible - can easily be set on fire.
- Explosive/reactive - can detonate or explode through exposure to heat, sudden shock, pressure or incompatible substances.
- Corrosive - chemical action can burn and destroy living tissues or other materials when brought in contact.
- Toxic - capable of causing injury or death through ingestion, inhalation or skin absorption.

General rules for identifying product hazards

- Buy products with informative labels.
- Do not entirely rely on the word "nontoxic" on the product's label. A product that qualifies as nontoxic can still contain hazardous ingredients, but not in large enough amounts to cause an acute reaction. Chronic hazards often are not considered
- If a product does not have sufficient information on the label, contact the manufacture for an MSDS.
- Carefully read all sections of the MSDS prior to using the product and follow all precautionary advice.
- Do not consider an MSDS to be the complete source of hazardous information on a product.
- Do not assume that a section left blank signifies the lack of potential harm. If a product is not very hazardous, the sections should contain information showing that this is the case.

Introducing the Material Safety Data Sheet

A Material Safety Data Sheet (MSDS) is usually a one or two page document that provides a variety of information about any product you purchase. All hazardous chemicals manufactures and distributors are required by Occupational Safety and Health Administration (OSHA) to provide an MSDS. However, the quality of this information may vary significantly depending upon the thoroughness of the manufacturer, yet it is up to you to assure you have MSDS's on file at the workplace for every product you use.

If an MSDS was not provided with the product itself, you may obtain a copy by writing to the manufacture or the distributor. Employers who use, store or manufacture hazardous materials are required by law to make the MSDS available to all employees who could be exposed to the material. Fines have been assessed on small businesses by OSHA for failure to have complete MSDS records available to employees.

There are two important things to look for when receiving an MSDS:

1. Check to see that the MSDS is written with your intended use of the product in mind. For example, if a product is to be sprayed, but the MSDS only describes the characteristics of the product in powdered or in liquid form, request additional information.
2. Check the date that the MSDS was prepared. If it does not provide a preparation date, or if is several years old, request an updated copy.

Although there is no standard MSDS format, all Material Safety Data Sheets must contain the same basic information. This information typically is divided into eight major sections. In any of these sections, the letters "ND" signify "not determined" and the letters "NA" signify "not applicable."

1. Material Manufacture and Identification

This section identifies the product and gives the name, address and emergency telephone number of its manufacture. The product may be listed by its chemical name or trade name. For example, sodium hypochlorite is a chemical name and Brite Bleach is its trade name. If the product is a mixture of several chemicals, only its trade name will be used. The product also may have a CAS (Chemical Abstract Service) number. CAS is an organization that indexes information about chemicals. Through the use of the CAS number, you can look up additional product information in a variety of sources, such as textbooks on toxicology, found at your local library. The date of preparation of the MSDS should also be provided in this section.

2. Hazardous Ingredients/Identity Information

This section lists the product ingredients subject to regulations and standards and lists the percentage of each ingredient by total weight. The product ingredients may be listed by chemical name and by common name. Information may also be provided on ingredient concentration levels that could produce a health hazard. This concentration may be stated in terms of PEL, LD50 or TLV.

- The **PEL** (Permissible Exposure Limit) established by OSHA, is the amount of an airborne substance that most healthy adult workers can be exposed to at work without adverse

effect. PEL's are enforceable by law in the workplace.

- The **LD50** represents the lethal dose that will kill 50 percent of the test animals in laboratory experiments through either skin contact or ingestion. The laboratory results are used to estimate a substance's toxicity to humans by adjusting the test results according to human body weight and characteristics. Because toxic substances have different effects on different species, researchers usually are conservative in their estimates of the effect a substance will have on humans.

- The **TLV** (Threshold Limit Value) is the recommended airborne concentration of a substance that nearly all workers can be exposed to without adverse effects. In general, the lower the TLV, the greater the potential for adverse health effects. There are three types of TLV's:

  Time Weighted Average (TLV/TWA)-The recommended exposure concentration for a normal 8-hour workday, 40-hour workweek. If the MSDS lists only TLV, it usually refers to this value.
  Short Term Exposure Limit (TLV/STEL)-The recommended exposure concentration above the TWA for a limited number of 15-minute exposure periods.
  Ceiling Exposure Limit (TLV/C)- The recommended exposure concentration that should not be exceeded at any time during the work period.

  TLV's are not guarantees:

  - They do not take into consideration exposure values for children, pregnant women or hypersensitive individuals, or other high risk groups.
  - They do not apply to shifts longer than 8 hours, or to people who live and work in the same environment.
  - TLV's are revised as new studies reveal hazards that were previously undetected.
  - There are some substances known to be toxic that have no TLV's because of insufficient data to quantify the risk from exposure.

  Notations often used with TLV's and PEL's

  - **ppm -** parts per million measures the concentration of a gas or vapor in the air, or the concentration of a liquid or solid.
  - **mg/m3** - milligrams of chemical substance per cubic meter of air is use for concentrations of dusts, gases or mists.
  - **"S" or "Skin"** - indicates that the substance may be absorbed through skin, mucous membranes and eyes.

  - **mg/kg** - milligrams per kilogram of body weight is the measure of solids or liquids usually given by ingestion or injection.

3. Physical/Chemical Characteristics

This section describes the physical characteristics of the product, such as whether it is a liquid, solid or gas at room temperature; how much vapor it forms; whether the vapor rises or settles; and whether the product dissolves in water.

The following provides definitions of commonly used physical/chemical data terms.

Boiling point is the temperature at which a liquid boils at sea level.

Vapor pressure indicates how easily a liquid will evaporate and is measured in millimeters of mercury (mm Hg). Liquids with higher vapor pressure require better ventilation. A liquid is considered volatile when its vapor pressure exceeds 5 or 6 mm Hg.

Vapor density is the weight of a vapor or gas compared to an equal volume of air. Air is rated as 1. Vapors heavier than air (toluene is 3.2) accumulate in low areas where they may pose health hazards to small children and pets and may cause fire hazards.

Specific gravity is the ratio of the weight of a product's known volume to the weight of an equal volume of water. A specific gravity of greater than 1 means the substance will sink in water; less than 1 means it will float on water. Most flammable liquids are lighter than water.

Melting point is the temperature above which a solid changes to a liquid.

Evaporation rate is the rate at which a product will change from a liquid to a gas when compared to the evaporation rate of a known material. Normal butyl acetate (n-BuAc), which has an evaporation rate of 1.0, is commonly used for comparison. A slow evaporation rate is considered less than 0.8 (water is 0.3). A fast evaporation rate is considered greater than 3.0 (acetone is 5.6). Fast evaporating solvents can release hazardous amounts of vapors into the air quickly and should only be used in well ventilated areas and with appropriate safety equipment.

Solubility in water is the quantity of a product that will dissolve in water at room temperature. It is expressed either as a percentage or by one of the following terms:

- negligible - less than 0.1 percent
- slight - 0.1 to 1 percent
- moderate - 1 to 10 percent
- appreciable - more than 10 percent
- complete - 100 percent

This term has important health consequences. For example, gases with low water solubility are more likely to reach the deep tissues of the lungs; highly soluble gases are more likely to dissolve into the moist mucous membranes of the upper airways.

Percent volatile means the percentage of a liquid or solid that will evaporate at 70 degrees F (unless another temperature is indicated). If the percent volatile exceeds 10

percent, be sure to use the product in a well ventilated area.

Appearance and odor may help to identify the product and help to verify that you have the appropriate MSDS.

4. Fire and Explosion Hazard Data

This section describes the circumstances under which the product may ignite or explode and provides instructions on how to deal with these hazards. The following describes the terms in this section.

Flash point is the lowest temperature at which sufficient vapors from a liquid are present that the air/vapor mixture will ignite when exposed to an ignition source. A product with a flash point near or below 100 degrees F is particularly dangerous because exposure to any ignition source, such as a spark from static electricity or a burning cigarette, may set off a fire or explosion. For example, extreme caution should be used when handling and storing gasoline because it has a flash point of -50 degrees F.

Flammable limits are the lowest and highest concentrations of vapor or gas in the air that will ignite when exposed to a spark or flame. The Lower Flammable Limit is the LFL (or LEL) and the Upper Flammable Limit is the UFL (or UEL). Products with wide flammable limits (such as ethyl ether, 1.9-36) may ignite either near or far from an ignition source. When considering the explosion hazards, the LFL is the most important. The lower the LFL, the less of a substance needed in the air before it can ignite.

Extinguishing media refers to materials that can extinguish a fire, such as foam, water, carbon dioxide or dry chemical. The appropriate fire extinguisher depends upon the source of fire.

Special fire fighting procedures may recommend special protective equipment to use or special fire fighting measures to follow.

Unusual fire and explosion hazards covers factors such as toxic or irritant gases that may be released in a fire.

5. Reactivity Data

This section tells how the product will react under particular environmental conditions. The following provides definitions of the terms used to describe reactivity.

Stability indicates whether the product will decompose over time and the environmental conditions, such as heat or direct sunlight, that may cause a dangerous reaction.

Incompatibility indicates which chemicals should not come in contact with the product. Store and use separately any materials that are identified as incompatible.

Hazardous decomposition products indicates which hazardous substances might be released during fires or from decomposition.

Hazardous polymerization is a process by which the molecules of a chemical can combine to form larger molecules (polymerize). If this chemical reaction happens too quickly, it may produce a great amount of heat (especially when large quantities of materials are involved), which may result in a fire or explosion. If a polymerization hazard exists, specific storage instructions and the shelf life of the chemical should be listed.

6. Health Hazard Data

This section provides a combined estimate of the total known hazard of the product. It describes routes of exposure and effects of acute and chronic exposure, including the signs, symptoms, and diseases that may result from excessive exposure, any medical conditions that are generally recognized as being aggravated by exposure to the product, and emergency and first aid procedures to follow in case of overexposure. It may also indicate whether the hazardous product is listed in the National Toxicology Program (NTP) Annual Report on Carcinogens or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) or by OSHA.

Hazardous substances may enter the body through one or more of these routes:

Ingestion--eating or drinking hazardous substances or contaminated food or water.
Inhalation--breathing in hazardous gases, vapors, dust and sprays.
Skin contact/absorption--Hazardous products containing corrosives or irritants can injure the skin and may be slowly absorbed into the body tissues and bloodstream. Some hazardous substances such as organic solvents can be absorbed through skin contact without damaging the skin and without your being aware of it. Many hazardous products may cause eye damage if splashed into the eye. Eyes are particularly vulnerable to injury from hazardous substances.

Acute health effects are signs and symptoms that result from a single exposure, such as headaches, dizziness, skin or eye irritation, vomiting, coma or death. Symptoms usually occur shortly after exposure and may range from minor to severe.

Chronic health effects are gradual and occur through repeated exposure over an extended period of time. Examples include cancers, liver or kidney damage, birth defects or central nervous system damage.

7. Precautions For Safe Handling and Use

This section indicates procedures for cleaning up spills and leaks and disposing of the product. In general, information on disposal is not supplied in detail because local, state and federal regulations vary. Check with your local or state waste officials for proper disposal procedures. This section also provides information that might not be listed elsewhere on the MSDS, such as handling and storage information, and cleaning or disposing of contaminated clothing.

8. Control Measures

This section describes personal protective equipment, work practices and ventilation procedures to use when working with the product.

Hazardous Waste Characteristics

The MSDS is not always the best source of information for determining whether a product is hazardous. Sometimes a material may not be described as hazardous in the MSDS, but is in fact regulated by state or federal law. It may be a **characteristic waste** or a **listed waste**. You should become familiar with the following concepts.

Characteristic Wastes

Ignitable waste - (D001) A liquid waste with a flash point less than 140 F; or, a non-liquid waste which is capable, under standard temperature and pressure of causing fire through friction, absorption of moisture, or spontaneous chemical changes and when ignited, burns vigorously. There are also oxidizing wastes which add oxygen to a fire. Oxidizing substances often have per at the beginning of the name, oxide at the end of its name, or ate in its chemical name.
Corrosive waste - (D002) A water-based waste having a pH of less than or equal to 2.0 (strong acids) or greater than or equal to 12.5 (strong bases); also, any liquid able to corrode 1/4 steel per year.
Reactive waste - (D003) An unstable or explosive waste which reacts violently in the presence of water and sulfide, cyanide bearing wastes which, when exposed to pH conditions between 2.9 and 12.5, liberate toxic vapors.
Toxicity Characteristic waste - (D004-D043) A waste which releases toxic metals, pesticides or volatile organic chemicals above certain limits under acidic conditions.

Listed Wastes - Specific materials regulated under federal regulations.

F-List - Hazardous wastes from non-specific sources such as:

1. **F001** - spent halogenated solvents used in degreasing such as trichloroethylene, methylene chloride, 1,1,1-trichloroethane and carbon tetrachloride.
2. **F002** - spent halogenated solvents such as those above, but not used as degreasers; other examples are 1,1,2-trichloro-1,2,2 trifluoroethane and chlorobenzene.
3. **F003** - spent non-halogenated, ignitable solvents such as xylene, acetone, methanol and methyl isobutyl ketone;
4. **F004** - spent halogenated solvents such as cresol, cesylic acid and nitrobenzene;
5. **F005** - spent non-halogenated solvents such as toluene, methyl ethyl ketone (MEK), carbon disulfide and benzene;

6. Spent solvent mixture/blends containing 10% before use of F001, F002, F004 and/or F005; and,

7. Distillation bottoms from recovering solvents.

K-List - Hazardous waste from specific sources such as certain plating bath solutions; wastewater treatment sludge, and wastes from the heat treatment of metals.

P-and U-Lists - Discarded commercial chemical products, off-specification products, containers and/or spill residues.

It is important that you and your employees take hazardous materials very seriously. You should always be looking for ways to eliminate hazardous materials from your processes altogether.

For More Information, Contact:

Division of Solid & Hazardous Waste - (801) 538-6170
Environmental Hotline - 1 (800) 458-0145
Pollution Prevention Coordinator - (801) 536-4477
Division of Water Quality - (801) 538-6146